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GREAT LAKES FORESTRY CENTRE
CENTRE FORESTIER DES GRANDS LACS

Results of forest insect and disease surveys in the NORTH CENTRAL REGION of Ontario, 1986

CARRIED OUT BY THE GREAT LAKES FORESTRY CENTRE IN COOPERATION WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES

H. J. Evans and S. G. Payne
Miscellaneous Report No. 56

Canada

87-05591/

THE GREAT LAKES FORESTRY CENTRE

The Great Lakes Forestry Centre is one of six regional centres located across Canada and operated by the Canadian Forestry Service. The Service provides federal leadership and a national focus in the forestry sector for the continuing economic, social and environmental benefit of Canadians. The Centre conducts two major programs: research and technical services, and forestry development. Both programs address major problems affecting forest management and the forested environment in Ontario. Because of the transprovincial nature of the forest resource, many elements of the research program are of national significance.

For many years the research program was guided by the Canada-Ontario Joint Forestry Research Committee, made up of senior members of the Centre and the Ontario Ministry of Natural Resources. Responsibilities for coordinating all forestry research in Ontario have now been assumed by the Ontario Forestry Research Committee, which has representatives from forest industry, universities and federal and provincial governments. This Committee also ensures that research results are transmitted to forest managers.

Staff of the forestry development program negotiate and administer federal-provincial cost-sharing agreements with the province of Ontario, conduct economic studies, and assist in implementing job creation programs in the forest sector. This requires close cooperation with the Ontario Ministry of Natural Resources and with other provincial and federal agencies concerned with the forest sector.

The Centre recognizes that forested land must be managed in the best public interest, not only for the wood production essential to our economy but also for the recreational purposes that are so important to our social well-being. These goals must be achieved in a manner that will maintain or improve the quality of the forest environment and preserve it for generations to come.

RESULTS OF FOREST INSECT AND DISEASE SURVEYS IN THE NORTH CENTRAL REGION OF ONTARIO 1986

(FOREST DISTRICTS: ATIKOKAN, THUNDER BAY, NIPIGON, GERALDTON AND TERRACE BAY)

H.J. EVANS and S.G. PAYNE

GREAT LAKES FORESTRY CENTRE

CANADIAN FORESTRY SERVICE

GOVERNMENT OF CANADA

1987

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SURVEY HIGHLIGHTS

This report deals with the major forest insect and disease conditions that occurred in the North Central Region in 1986. Spruce budworm, which is covered in a separate report, continued to cause moderate-to-severe defoliation in susceptible stands through much of the region. Insects whose populations increased noticeably were the large aspen tortrix and the white pine weevil. Declining infestations of the forest tent caterpillar and jack pine budworm are reported.

Damage caused by western gall rust and the spruce needle rusts increased, whereas little change was reported in the status of Armillaria root rot, Dutch elm disease and Scleroderris canker. Abiotic factors that caused tree damage in 1986 included salt and frost.

Special surveys were conducted in black spruce plantations, and cones of that species were also examined for pest problems. The Acid Rain National Early Warning System was continued as was sampling to determine the occurrence of the pinewood nematode. Semipermanent sample plots in trembling aspen stands were reexamined to determine fluctuations in the incidence of Hypoxylon canker.

A staff change occurred with the reassignment of W.D. Biggs to the Central Region after eight years of service in the North Central Region. He has been replaced by H.J. Evans, who joins incumbent S.G. Payne.

The format for this report remains unchanged from that of 1985. Insects and diseases are categorized as follows:

Major Insects or Diseases

capable of causing serious injury to or death of living trees or shrubs

*Minor Insects or Diseases**

capable of causing sporadic or localized injury but not usually a threat to living trees or shrubs

*No minor diseases were reported in the North Central Region in 1986.

Frontispiece

Frost damage to new shoots of white spruce (*Picea glauca* [Moench] Voss)

Gypsy moth, *Lymantria dispar* (L.), pheromone trap designed to attract and capture male moths

Other Forest Insects/Diseases (Tables)

These tables provide information on two types of pest:

1) those which are of minor importance and have not been known to cause serious damage to forest trees,

2) those which are capable of causing serious damage but, because of low populations or for other reasons, did not cause serious damage in 1985.

The valuable assistance and cooperation of personnel of the Ontario Ministry of Natural Resources (OMNR), various forest industries, other government agencies and private individuals during the 1986 field season are gratefully acknowledged.

H.J. Evans
S.G. Payne

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INSECTS

Major Insects

Large Aspen Tortrix, *Choristoneura conflictana* (Wlk.)

A dramatic increase in the area infested by this insect occurred in 1986. The area within which moderate-to-severe defoliation occurred increased over 10 times from 20,900 ha to 233,580 ha (Fig. 1). Whereas defoliation levels did not exceed 90% in 1985, this year large tracts of trembling aspen (*Populus tremuloides* Michx.) were totally denuded of foliage by the tortrix (see photo page). These stands subsequently produced a second crop of leaves.

The vast majority of the damage was reported from the Thunder Bay District. The largest infestation of 120,200 ha extended from Gunflint Lake to Lake Superior along the Ontario-Minnesota border. Another sizable area of 76,670 ha included most of the Sibley Peninsula and the adjacent area from Loon Lake west to Kingfisher Lake. The infestation to the south and east of Lac des Iles was 23,600 ha in size. Other areas of smaller infestations occurred south of the city of Thunder Bay from Brule Bay to Sturgeon Bay and on Pie Island in the Dog Lake area, and north of Dorion along the Wolf River. In the Nipigon District, a small area of moderate defoliation occurred near the town of Red Rock and increased populations were noted through much of the southern part of the district. Two relatively small areas of moderate-to-severe damage were reported in the Terrace Bay District. Near the town of Terrace Bay a 2-ha area was infested and another area of 8 ha was similarly infested along Highway 627 between Pukaskwa National Park and the Pic River Indian Reserve. Low numbers of the pest were encountered at Klotz Lake and MacLeod provincial parks in the Geraldton District.

Associated insects feeding in conjunction with the large aspen tortrix were found at some locations in the Thunder Bay District. The tortrix has completely engulfed some areas previously infested with forest tent caterpillar, *Malacosoma disstria* Hbn.; however, significant numbers of caterpillars were recorded in the Sturgeon Bay area. In the Mountain Lake area high numbers of Bruce spanworm, *Operophtera bruceata* (Hlst.), contributed to the overall foliar damage and the aspen twoleaf tier, *Enargia decolor* (Wlk.), was encountered at low population levels in several infested areas in the southern part of the district.

The last major infestation of the large aspen tortrix caused moderate-to-severe defoliation in aspen stands over large areas of the North Central Region from 1969 to 1974. On the basis of this last infestation and others elsewhere in the province, it is expected that the present infestation will continue and likely increase in 1987.

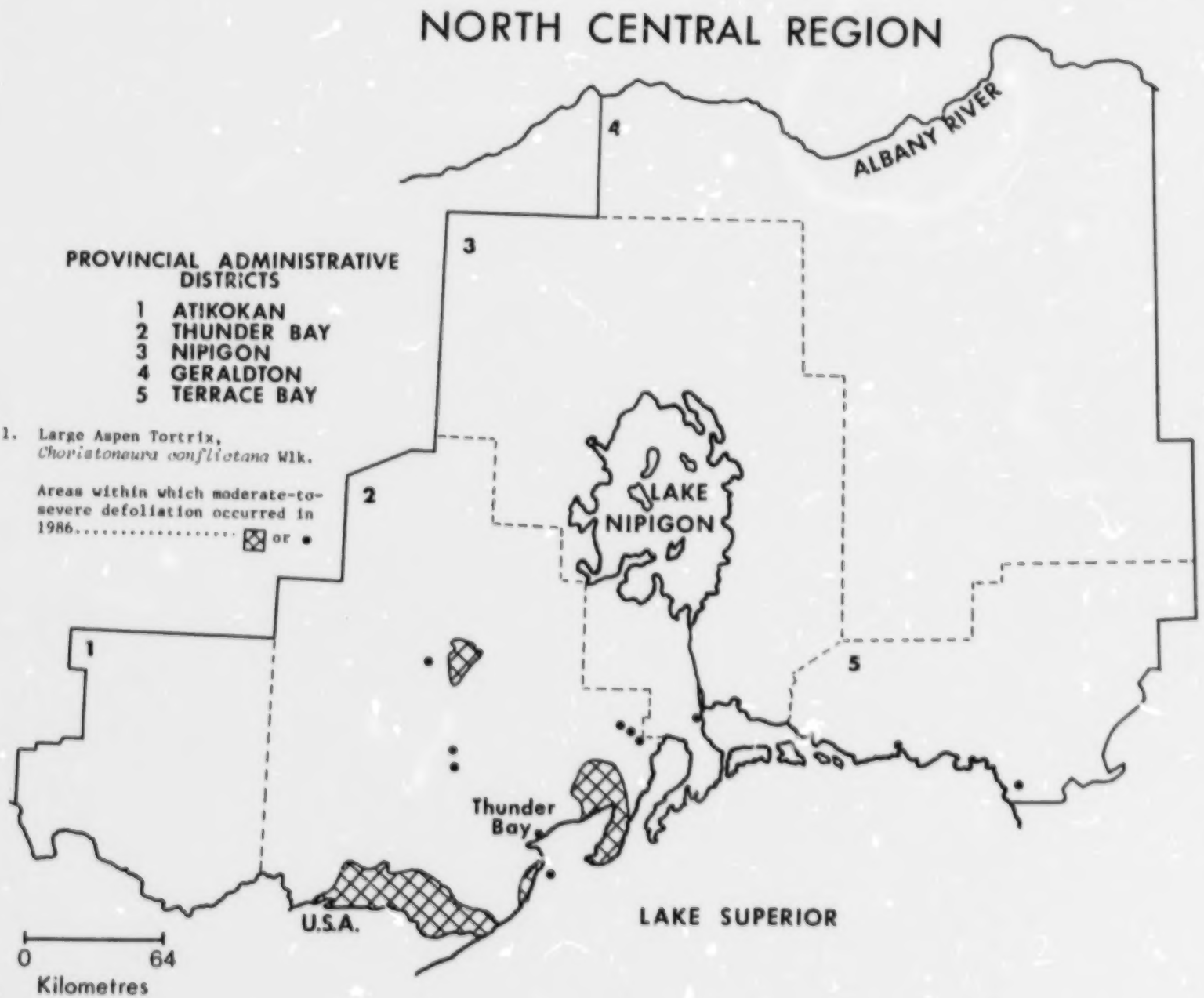

Figure 1. Large Aspen Tortrix, *Choristoneura conflictana* Wlk.

Areas within which moderate-to-severe defoliation occurred in 1986..... ⊠ or •

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

Results of damage surveys, population sampling and egg-mass counts of this pest will be published with those of other regions at a later date in a report specifically devoted to this insect. That report will provide a complete description and analysis of developments in the spruce budworm situation in Ontario in 1986 and will give infestation forecasts for the province for 1987.

Jack Pine Budworm, *Choristoneura pinus pinus* Free.

The area of infestation by the jack pine budworm, which began declining in 1985, was further reduced in size in 1986. The only area of significant damage occurred in the northwest corner of the Atikokan District, where a total of 31,391 ha of jack pine (*Pinus banksiana* Lamb.) was moderately defoliated. This infestation extended from the west side of White Otter Lake southwest around Sedgwick Lake and continued southwest to the Fort Frances District boundary (Fig. 2). Average defoliation generally did not exceed 50% and the infestation was characterized by inconsistent and discontinued areas of damage, perhaps as a result of the insecticidal spray program which the Ontario Ministry of Natural Resources (OMNR) conducted over much of this area. Elsewhere in the Atikokan District, low populations were common in previously infested areas. No areas of infestation were reported in the Thunder Bay District; however, low numbers of insects were collected at several locations. Low populations were also evident at points along the Catlonite Road and Kimberly-Clark Road 15 in Geraldton District and along the Lemay Road in Terrace Bay District.

No significant changes occurred in the area of tree mortality and top kill of jack pine reported in 1985. This area remains confined to the south-central portion of Quetico Provincial Park, Atikokan District.

Egg-mass counts at several locations in the Atikokan and Thunder Bay districts indicate a reduction in populations from those of 1985 at most locations (Table 1). Infestation forecasts for 1987, according to the modified system, show that either populations will be negative or only light infestations will occur in 1987.

Linden Looper, *Erannis tiliaria* (Harr.)

In 1986, a small area of moderate damage was observed in the southern part of the Terrace Bay District. The main area of damage was in the area of the Boy Scout plantations near the town of Marathon south of Highway 17. Over a 5-ha area young white birch (*Betula papyrifera* Marsh.), cherry (*Prunus* spp.) and mountain maple (*Acer spicatum* Lam.) had defoliation levels varying from 20% on the birch and cherry to 50% on the maple. Mature deciduous trees in the area had only trace levels of damage.

ATIKOKAN DISTRICT

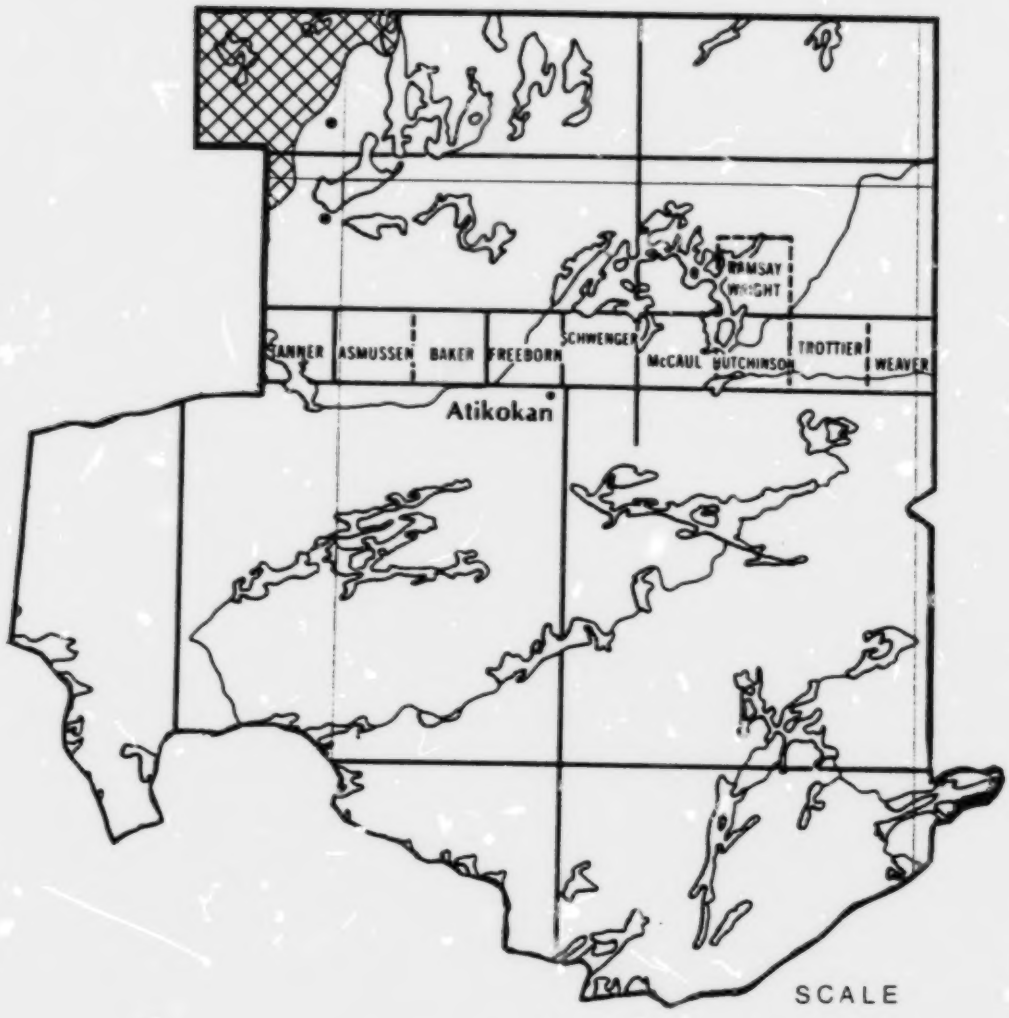

Figure 2. Jack Pine Budworm, *Choristoneura pinus pinus* Free.

Areas within which moderate defoliation occurred in 1986..

Table 1. Jack pine budworm egg-mass counts and defoliation estimates in 1986 and infestation forecasts for 1987 in the Atikokan and Thunder Bay districts (based on the examination of six 61-cm jack pine branches at each location).

Location	Defoliation 1986 (%)	Total no. of egg masses		Standard infestation forecasts for 1987[a]	Modified[b] infestation forecasts for 1987[a]
		1985	1986		
Atikokan District					
Burt Lake	6	5	4	M	L
Crook Lake - South	26	-	4	M	L
- North	16	-	6	H	L
Derby Creek-spray plot	5	1	1	L	L
Dibble Lake	31	15	11	H	L
Duff Lake	5	11	5	M	L
Harvey Lake	16	3	0	N	N
Irene Lake	3	0	2	L	L
Lindgen Lake	8	4	4	M	L
Mahon Lake-spray plot	7	6	0	N	N
Nym Lake	6	2	2	L	L
Pekagoning Lake	3	18	3	M	L
Rutter Lake - NE	51	10	1	L	L
- N (spray plot)	6	-	2	L	L
Sedgwick Lake	22	2	3	M	L
Side Lake - spray plot	3	37	3	M	L
Turtle River	56	14	5	M	L
Windigoostigwan Lake	8	0	0	N	N
Thunder Bay District					
Ames Twp	4	0	3	M	L
Hardwick Twp	1	0	0	N	N
Moss Twp	10	-	0	N	N
Nelson Lake	1	0	0	N	N
Northern Light Lake- Curran Bay	1	4	0	N	N
- Southeast Bay	2	0	0	N	N

(cont'd)

Table 1. Jack pine budworm egg-mass counts and defoliation estimates in 1986 and infestation forecasts for 1987 in the Atikokan and Thunder Bay districts (based on the examination of six 61-cm jack pine branches at each location) (concl.).

Location	Defoliation 1986 (%)	Total no. of egg masses		Standard infestation forecasts for 1987[a]	Modified[b] infestation forecasts for 1987[a]
		1985	1986		
Plummes Lake	2	0	0	N	N
Rush Creek Rd	19	-	5	H	L
Squeers Lake	1	0	2	L	L
Upper Shebandowan Lake	1	0	1	L	L

[a] N = nil, L = light, M = moderate, H = heavy

[b] Modified Infestation Forecasts

During the last major jack pine budworm outbreak in Ontario, the following standard jack pine defoliation forecast was developed:

Total egg masses on six 60-cm tips (Year X)	Defoliation forecast (Year X + 1)	Defoliation % (Year X + 1)
0	0	0
1-2	light (L)	1-25
3-5	moderate (M)	26-75
6+	severe (S)	76+

This relationship was found to be reliable during the first year or two of the current jack pine budworm outbreak, but in older infestations (3-4 years) it generally overestimated the defoliation potential. The "modified infestation forecast" presented in Table 1 is based on analysis of egg-mass counts and subsequent defoliation for 1984, 1985 and 1986 from northwestern and northeastern Ontario. The reasons for modifying the forecast are related to an increase in parasitism rates and a reduction in the production of male flowers.

Birch Leafminer, *Fenusa pusilla* (Lep.)

This perennial pest of white birch was again prevalent on ornamentals in most urban areas of the region. Variable damage, often with close to 100% of the foliage affected, was noticeable in the city of Thunder Bay and in the towns of Geraldton and Longlac. Moderate-to-severe browning of foliage on open-grown fringe trees and small clumps of forest trees occurred at numerous locations in the townships of Paipoonge, Conmee, Oliver, McIntyre, Gorham, Fowler, Ware and Upsala, Thunder Bay District. Similar damage occurred at several locations in the Geraldton District and one notable 5-ha area west of Clavet Township had 99% foliar damage. A more sporadic occurrence of this leafminer was

recorded in Atikokan, Nipigon and Terrace Bay districts, where varying degrees of damage were reported.

American Aspen Beetle, *Gonioctena americana* (Schaef.)

A substantial increase in population levels occurred in the eastern half of the region in 1986. Defoliation was commonly found along Kimberly-Clark Road 15, Geraldton District. In conifer plantations along this road, regeneration trembling aspen had 20 to 40% defoliation. Along Highway 625, 10 km north of Caramat in Geraldton District, young regeneration aspen in a 10-ha mature forest had defoliation levels between 10% and 40%. Areas of light defoliation were commonly found in scattered areas in eastern Geraldton and Terrace Bay districts.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

The forest tent caterpillar infestation, which began in 1977 in the Thunder Bay District, decreased in size from 5,000 ha in 1985 to 520 ha this year. The area within which moderate-to-severe damage occurred to trembling aspen was between Cloud Lake and Lake Superior in Crooks Township (Fig. 3). The foliar damage in this area, where defoliation ranged upwards to 90%, was exclusively the result of tent caterpillar feeding. At other locations, particularly along the Sturgeon Bay Road in Blake Township, low populations were found in conjunction with the large aspen tortrix. Infestations collapsed at numerous locations along Lake Superior south of the city of Thunder Bay; however, increasing numbers of the large aspen tortrix caused similar damage to aspen in some of the same areas previously infested by the tent caterpillar.

Elsewhere in the region, trace populations were common at several widespread locations in all districts. In one notable area, at MacLeod Provincial Park in Ashmore Township, Geraldton District, larvae were found to be numerous but defoliation did not exceed 5% and no eggs were found, an indication that populations will remain at very low levels in 1987. Egg-band counts to forecast infestation projections for 1987 were done at six locations in the Thunder Bay District (Table 2).

Red Pine Sawfly, *Neodiprion nanulus nanulus* Schedl.

In 1985, there were several areas in the region in which moderate-to-severe damage was recorded; however, in 1986 populations declined. Damage was significant only in one area in Legault Township, Nipigon District, where a few sapling jack pine sustained 85% foliar damage. Widely scattered colonies caused less than 5% defoliation along Highway 584 and in Ashmore Township, Geraldton District. In the Thunder Bay District, low numbers causing less than 10% foliar damage occurred on scattered individual trees in Fowler, MacGregor, Inwood, Hagey and Conacher townships.

THUNDER BAY DISTRICT

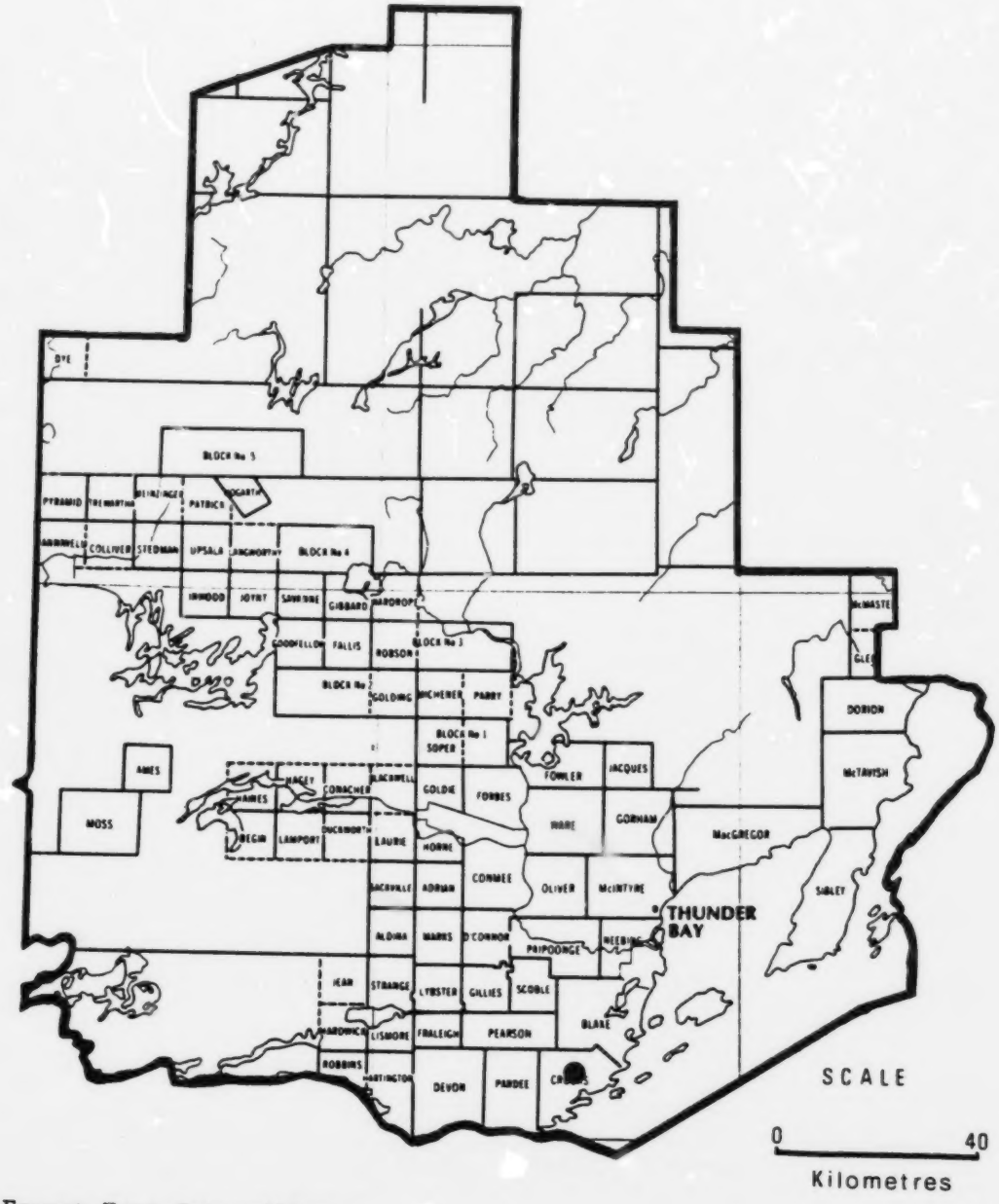

Figure 3. Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

Areas within which moderate-to-severe defoliation occurred in 1986 ..... ●

Table 2. A summary of forest tent caterpiller egg-band counts on trembling aspen in the North Central Region in 1986, with infestation forecasts for 1987.

Location (Twp)	Avg DBH of trees (cm)	Avg no. of egg bands per tree	Infestation forecast for 1987
Geraldton District			
Ashmore	12	0	nil
Thunder Bay District			
Blake	14	8	moderate
Crooks	14	18	heavy
Neebing	16	0	nil
Neebing - Hwy 61	15	0	nil
Pardee	14	1	light
Scoble	15	0	nil

Yellowheaded Spruce Sawfly, *Pikonema alaskensis* (Roh.)

The most serious damage caused by this sawfly in 1986 occurred at the OMNR tree seed orchard in O'Connor Township, Thunder Bay District. At this location approximately 10% of the black spruce *(Picea mariana* [Mill.] B.S.P.) were infested and the foliar damage averaged 15%; however, a few trees were more heavily attacked and some suffered close to 100% defoliation. Because of the high populations and special value of these trees, control measures were taken by OMNR staff who used a ground spray of malathion on 19 July, 1986. An effective population control was achieved.

Two areas of damage to white spruce *(Picea glauca* [Moench] Voss) regeneration were detected. Near Kerr Lake, Atikokan District affected trees in a small 1-ha plantation had an average of 20% foliar damage, and on the Boyce Road, Geraldton District, natural regeneration white spruce had an average of 25% defoliation on affected trees.

Moderate-to-severe levels of damage on ornamental spruce plantings and on roadside trees were evident at several locations in the region. Notable areas of damage in the Thunder Bay District were in Kakabeka Falls Provincial Park, along Highway 11-17 from Thunder Bay west to Kakabeka Falls, in the Pass Lake area, near English River, and within the city of Thunder Bay. One area east of Jellicoe in the Nipigon District was affected and defoliation averaged 35%.

White Pine Weevil, *Pissodes strobi* (Peck)

Population levels of the white pine weevil have fluctuated considerably over the years. In 1986, numbers of this pest and subsequent damage to leaders of sapling-sized jack pine and spruce trees increased from 1985 levels. Relatively heavy leader damage of more than 10% was encountered at a number of locations across the region in jack pine and in black and white spruce plantations (Table 3). Small roadside spruce and jack pine were commonly weevilled along highways 11 and 17 through the Geraldton, Nipigon and Thunder Bay districts. In addition, this weevil was recorded at 7 of 12 black spruce plantations of various heights during a special survey of this tree species in 1986 (see Special Surveys).

Larch Sawfly, Pristiphora erichsonii (Htg.)

Population levels of this defoliator of tamarack (*Larix laricina* [Du Roi] K. Koch) declined throughout the entire region in 1986. In the Thunder Bay District, moderate-to-severe defoliation recurred in a 2-ha stand near Kabigon Lake, but light damage occurred in previously heavily infested areas in Upsala Township and along Highway 11-17 in Neebing Township. Light damage continued in Errington Township and along Highway 584 near Murky Creek, both in Geraldton District. In Atikokan District, young trees along Highway 622 had defoliation levels of 10% to 30% and in the Lerome Lake area light damage prevailed, but occasional trees had moderate damage. At Middle Falls Provincial Park, Thunder Bay District, a small group of European Larch (*Larix decidua* Mill.) sustained an average of 20% foliar damage.

Mountain-ash Sawfly, *Pristiphora geniculata* (Htg.)

Following a decline in populations in the western half of the region in 1985, population levels were reduced in the eastern portion in 1986. Foliar damage to mountain-ash (*Sorbus americana* Marsh.) along the shoreline of Lake Superior was scattered and light, generally less than 20%. Throughout the region there were pockets of heavier damage, with defoliation ranging from 30 to 70%. Such damage was found in the Atikokan District in the vicinity of Nym, Marion, French and Clearwater West lakes and along Highway 623 south of Sapawe. Similar damage was noted in Sibley, Aldina and MacGregor townships and along Highway 527 from the Mott Lake Road to Highway 811, Thunder Bay District. Comparative levels of damage were found along Highway 580 north of Beardmore to Lake Nipigon, Nipigon District. As in previous years, the sawfly damage was common on ornamentals in urban centers of the region at defoliation rates varying from 10 to 65%.

Table 3. A summary of damage caused by the white pine weevil in five districts in the North Central Region in 1986 (counts based on the examination of 150 trees at each location).

Location	Area affected (ha)	Estimated trees/ha	Host	Avg ht of trees (m)	Leaders attacked (%)
Atikokan District					
Flanders Rd	5	2,200	jP	1.5	4.0
Stanton Lake Rd	5	2,500	jP	2.6	13.0
Sepawe - Upsula Rd	8	2,000	jP	1.5	12.0
Geraldton District					
Nakina Twp	10	1,600	jP	2.7	0.7
Pagwa SPA	5	1,100	wS	2.6	3.3
Nipigon District					
Hwy 527 S of Waweig Lake	20	2,500	jP	1.9	4.0
Limestone Lake, hydro line	10	1,600	bS	2.0	10.3
Limestone Lake, airstrip	20	1,600	bS	1.8	7.3
Pikitigushi Rd	10	2,500	jP	0.9	4.0
Tyrol Lake Management Unit	2	1,000	bS	2.3	4.7
Terrace Bay District					
Davies Twp	3	1,100	bS	3.0	7.3
Grenville Twp	4	1,600	wS	1.3	12.7
Thunder Bay District					
Camp 603	20	2,500	jP	1.2	14.0
Camp 300	20	5,000	jP	1.4	4.5
Colliver Twp	20	2,500	jP	3.1	15.0
Dorion Cut-off Rd	5	2,000	jP	1.5	12.0
Graham	5	3,500	jP	2.5	4.0
Madden Lake Road	10	2,000	jP	1.3	9.0

Minor Insects

Aspen Leafblotch Miner, *Phyllonorycter ontario* (Free.)

High populations of this leafminer recurred throughout the entire region in 1986. Young trembling aspen, under 10 cm in diameter, are most susceptible to damage from this pest; therefore, damage is commonly found in cut-over areas and along roadsides. In these susceptible areas it was normal for the foliage on the trees to be 100% damaged, with up to six mines per leaf. The foliage on the lower branches of larger trees was also attacked to a somewhat lesser degree.

Table 4. Other forest insects

Insects	Host(s)	Remarks
Acantholyda erythrocephala (L.) Pine false webworm	pine	found at two locations on ornamentals in the city of Thunder Bay, Thunder Bay District
Alsophila pometaria (Harr.)	mM, wE	moderate damage (up to 40%) in the Westfort area of the city of Thunder Bay, Thunder Bay District
Ambiens macrohaltica LeC. Alder flea beetle	alder	heavy defoliation by high populations in Boyce Twp, Geraldton District
Cephalcia fulviceps Roh. Pine webspinning sawfly	rP	foliar damage of 5% on a single tree at French Lake, Atikokan District
Coleophora laricella (Hbn.) Larch casebearer	tL	5% of foliage damaged on a small clump of semi-mature trees, along Hwy 614, 20 km south of Manitouwadge, Terrace Bay District
Dioryctria reniculelloides Mut. & Mun. Spruce coneworm	wS	moderate population in Adamson Twp, Nipigon District, and along Hwy 587 by Kabitotikwia River, Thunder Bay District

(cont'd)

Table 4. Other forest insects (cont'd)

Insects	Host(s)	Remarks
Diprion similis (Htg.) Introduced pine sawfly	Swiss stone pine	low population on a single ornamental tree at Lakehead University, Thunder Bay District
Enargia decolor (Wlk.) Aspen twoleaf tier	tA	low numbers found feeding in conjunction with large aspen tortrix in the southern Thunder Bay District
Epinotia solandriana (L.) Birch-aspen leafroller	tA, wB	trace levels found throughout the eastern half of the region
Eriocampa ovata (L.) Woolly alder sawfly	alder	up to 100% defoliation in the city of Thunder Bay and in McIntyre and Neebing twps, Thunder Bay District
Hylobius radicis Buch. Pine root collar weevil	jP	2% of trees killed in a 15-ha plantation along Greta Road, Geraldton District
Hyphantria cunea (Dru.) Fall webworm	deciduous	single nests found at many scattered points from the city of Thunder Bay west to Kakabeka Falls, Thunder Bay District
Malacosoma californicum pluviale Dyar Northern tent caterpillar	tA, w ch	scattered tents along Janet Lake Road, Terrace Bay District
Micrurapteryx salicifoliella Cham. Willow leafminer	W	Populations declined. Damage was much more scattered in the eastern half of the region than in previous years.

(cont'd)

Table 4. Other forest insects (cont'd)

Insects	Host(s)	Remarks
Neodiprion pratti banksianae Roh. Jack pine sawfly	jP	Two small colonies caused light damage to a single semimature tree in Ashmore Twp, Geraldton District.
Neodiprion virginianus complex Redheaded jack pine sawfly	jP	Populations declined. Scattered damage was evident in the southeastern Terrace Bay District.
Neurotoma inconspicua (Nort.) Plum webspinning sawfly	ch	light damage from several scattered nests in Ashmore Twp, Geraldton District
Operophtera bruceata (Hlst.) Bruce spanworm	deciduous	High numbers occurred in the Mountain Lake area of Thunder Bay District in conjunction with large aspen tortix; trace populations were found in Nipigon and Terrace Bay districts.
Phyllonorycter nipigon (Free.) Balsam poplar leafblotch miner	bPo	high populations found in numerous areas in the Thunder Bay-Kakabeka Falls-Pigeon River areas, Thunder Bay District
Pikonema dimmockii (Cress.) Greenheaded spruce sawfly	wS tA	Scattered colonies caused 5% defoliation of several ornamentals at the OMNR airbase in Ashmore Twp, Geraldton District.
Pseudexentera oregonana Wlshm. Aspen leafroller	tA	trace levels found in scattered areas of Geraldton District
Pyrrhalta decora decora (Say) Grey willow leaf beetle	W	100% of foliage damaged by high populations in the Barbara Lake SPA area, Terrace Bay District

(cont'd)

Trembling aspen (*Populus tremuloides* Michx.) stand heavily defoliated by large aspen tortrix, *Choristoneura conflictana* (Wlk.)

Trembling aspen (closeup) heavily defoliated by large aspen tortrix

Table 4. Other forest insects (concl.)

Insects	Host(s)	Remarks
Rhabdophaga swainei Felt Spruce bud midge	wS, bS	moderate levels found in scattered plantations in Thunder Bay District; trace levels on ornamental and roadside trees in Geraldton and Nipigon districts
Zelleria haimbachi Busck Pine needle sheathminer	jP	low populations in Ames Twp and the Northern Light Lake area, Thunder Bay District and in the Nym Lake area, Atikokan District

TREE DISEASES

Major diseases

Armillaria Root Rot, *Armillaria mellea* (Vahl:Fr.) Kummer

As in previous years, damage and subsequent mortality caused by this fungus were common throughout the region. For example, the disease was recorded in 1986 at three of 12 black spruce plantations during a special survey of that tree species (see SPECIAL SURVEYS). Across the region it was not unusual to find current mortality rates of 1% to 3% in young jack pine and black spruce plantations. An exception to these levels was found along Kimberly-Clark Road 15 at km 29, where a much higher level of damage was found. At this location, in an area of 250 m^2, there was a current mortality rate of 10% in young 3-m jack pine. Outside of this concentrated area of mortality in the remainder of the 5-ha plantation, the damage levels were significantly reduced.

Scleroderris Canker, *Ascocalyx abietina* (Lagerb.) Schläpfer-Bernhard

This disease has been a perennial problem in young jack pine plantations in the eastern half of the region. Again this year, as in 1985, low levels of damage, mainly to lower branches, were found at various sample locations. Along Highway 625 at km 4, 3% of the 9-year-old trees were infected with 1% mortality. This level of damage was typically found in the eastern half of the region. Samples were again submitted to the Great Lakes Forestry Centre to test for the more virulent European race of this disease. All results for the European race were negative.

Spruce Needle Rusts, *Chrysomyxa ledi* (Alb. & Schwein.) de Bary var. *ledi*, var. *cassandrae* (Peck & G.P. Clinton) Savile, and *C. ledicola* (Peck) Lagerb.

Foliar damage resulting from spruce needle rust increased over that of 1985 in some areas of the region. In the Thunder Bay District, the most evident damage was in low-lying natural stands of black spruce along Highway 17 from Raith west to English River. In this area, 30% defoliation was common on 100% of the trees in a stand. Occasional fringe or open-grown trees sustained up to 80% defoliation. In the Geraldton District along Highway 11, similar damage was reported at a number of locations. Again the heaviest damage was recorded on black spruce on low-lying sites. In most situations, 100% of the trees were affected and the foliar damage ranged upwards to 25%. Elsewhere in the region, light damage was common in natural stands.

Damage in plantations was usually relatively light; however, two areas of young black spruce in the Thunder Bay District did have significant rust infections. At one area on the Madden Road off Highway 811, 90% of 0.8-m trees were affected and defoliation averaged 20%. Along

the Mile 43 Road off Highway 527, 87% of 0.3-m recently planted trees were affected, and defoliation averaged 25%. In both of these areas scattered individual trees sustained heavy damage.

Needle Rust, *Coleosporium asterum* (Dietel) Sydow

Damage from this needle rust increased significantly from the low levels found in 1985. Along the Kimberly-Clark East Road at km 65 in Geraldton District, 63% of the 0.7-m jack pine in a 20-ha plantation had 5% of the foliage damaged. Along the same road at km 29, 94% of the 2-m trees in a 10-ha area had 4% of their foliage affected. In Hardwick Township, Thunder Bay District, in an 8-ha plantation, 76% of the 0.4-m trees had 15% foliar damage. In Stirling Township, Nipigon District, 55% of the 1-m trees in a 2-ha area had rust on 15% of their needles. Similar levels of damage were found across the region.

Tar Spot Needle Cast, *Davisomycella ampla* (J. Davis) Darker

This disease, which causes discoloration and premature casting of the old foliage of jack pine, was encountered at fewer locations in 1986 than in 1985. Scattered trees along the old Kawene Road in Atikokan District were as much as 50% defoliated, and in another area along the East Bay Road off Highway 527, approximately 5% of the saplings suffered up to 30% foliar damage. In a small area near Limestone Lake in Nipigon District, semimature trees sustained an average of 20% defoliation. Elsewhere in the region, only very low levels of the disease were recorded.

Western Gall Rust, *Endocronartium harknessii* (J.P. Moore) Y. Hirats.

Western gall rust affects jack pine of all ages, but it is most serious on young trees, where the presence of a gall on the main stem may kill the tree or cause deformation. Unlike most other rusts, this one does not require an alternate host but can spread from one pine to another directly. Surveys were conducted in areas of regeneration to determine the extent of the disease in 1986 (Table 5). Severely affected trees are defined as those with galls on the main stem or on 25% or more of the branches.

The impact of the disease on larger trees is usually confined to branch mortality. At the Kimberly-Clark nursery and in the surrounding area in Geraldton District, approximately 20 ha of mature jack pine had numerous infections that resulted in considerable branch mortality. Mature trees along a 2-km stretch of road on Highway 11 east of Highway 580 in Nipigon District had an average of 2% branch mortality.

Table 5. Summary of damage to jack pine caused by western gall rust at seven locations in the North Central Region (counts based on the examination of 150 trees at each location).

Location	Area affected (ha)	Estimated trees/ha	Avg ht of trees (m)	Trees affected (%)	Trees severely affected (%)
Atikokan District					
Fredrickson Lake	8	4,000	1.1	13	8
Geraldton District					
East Road - km 29	10	1,000	2.3	1.3	0
Road 17-2	10	1,200	2.2	14.6	4.6
Nipigon District					
Stirling Twp	2	3,000	1.1	0	0
Thunder Bay District					
Trewartha Twp	10	3,500	1.8	11	6
Hardwick Twp	8	2,500	0.4	3	2
Camp 602 Road	5	3,000	0.4	8	7

Table 6. Other forest diseases

Disease	Host(s)	Remarks
Asteroma microspermum (Peck) B. Sutton	wB	caused premature leaf discoloration along the East Road in Geraldton District and in the southern portion of Wintering Road, Terrace Bay District
Ceratocystis ulmi (Buism.) C. Moreau Dutch elm disease	wE	8% of surveyed trees affected in the city of Thunder Bay, Thunder Bay District
Chrysomyxa pirolata (Körn.) Spruce cone rust	bS	trace levels of damage to cones found in three plantations, Thunder Bay District

(cont'd)

Table 6. Other forest diseases (concl.)

Disease	Host(s)	Remarks
Cronartium coleosporioides Arthur Orange stalactiform blister rust	jP	scattered young individual trees affected in plantations in Trewartha Twp and at km 57 on Cp 602 road, Thunder Bay District
Ciborinia whetzelii (Seaver) Seaver Ink spot of aspen	tA	up to 5% defoliation in Kakabeka Falls Provincial Park, Thunder Bay District
Hendersonia spp.	bS	2% of trees affected and 30% of foliage damaged in Stirling Twp, Nipigon District
Isthmiella crepidiformis (Darker) Darker Needle cast	bS	100% of 2-m trees in a 0.5-ha area of a 10-ha plantation with 75% of old foliage damaged in McQueston Twp, Geraldton District
Linospora tetraspora G.E. Thompson Linospora leaf blight	bPo	associated with discoloration and early leaf drop in the Kakabeka Falls area, Thunder Bay District
Lophodermium pinastri (Schrader:Fr) Chev. Needle cast	jP	light damage to young trees along Kimberly-Clark Road 15 at km 6, Geraldton District
Melampsorella caryophyllacearum Schröter Fir broom rust	bF	several scattered trees affected in Kakabeka Falls Provincial Park, Thunder Bay District
Mycosphaerella effigurata (Schwein.) House Ash leaf spot	bAs	caused premature discoloration and leaf drop through the western half of the region
Sphaeropsis sapinea (Fr.) Dyko & B. Sutton Tip blight	rP	a small amount of branch flagging (up to 10%) on open-grown trees at French Lake, Dawson Trail Campground, Quetico Provincial Park, Atikokan District

ABIOTIC DAMAGE

Frost Damage

In 1986, late spring frosts resulted in damage to new shoots of conifers at numerous locations in the region (see frontispiece). In late May, exceptionally high daytime temperatures promoted early new shoot development. In weather records from Geraldton, maximum temperatures for the period 23-29 May were greater than or equal to 25°C each day and a maximum temperature of 32.2°C was recorded on 28 May. At the Thunder Bay Airport, temperatures were even warmer; for four consecutive days (27-30 May) the maximum high exceeded 30°C and the highest temperature of all, 35.2°C, was recorded on 30 May. This summery period was followed by very low overnight temperatures on several days in early June. In Geraldton freezing minimum temperatures were recorded on five dates between 1 June and 17 June. At Thunder Bay a low of -0.5°C occurred on 2 June and on a few other nights temperatures dipped to near freezing. It is during this period of June, when the young shoots are soft and succulent, that the frost damage occurs.

Damage was widespread and was recorded on balsam fir (*Abies balsamea* [L.] Mill.), white spruce and black spruce in both natural forests and plantations. The heaviest damage occurred in the Limestone Lake plantations, Nipigon District, where 4-m white spruce trees had 75% of the new shoots damaged in a 30-ha area. Lighter damage of 15-35% was reported on young white spruce and balsam fir in numerous areas through the districts of Nipigon, Geraldton, Thunder Bay and Terrace Bay. Damage to black spruce in the same areas was generally lighter as shoot development was somewhat retarded in comparison with that of the other two species. Only traces of damage occurred in the Atikokan District.

Salt Damage

Tree damage from deicing salt used on roadways is commonly found in northern areas with severe winter driving conditions. Fringe trees along major routes are most susceptible to damage. Moderate-to-severe damage to red pine (*Pinus resinosa* Ait.) and eastern white pine (*Pinus strobus* L.) occurred along the fringes of Highways 11-17 and 102 at several points in the vicinity of the city of Thunder Bay. Red pine in the Boy Scout plantations along the highway into Marathon, Terrace Bay District, was moderately damaged and young eastern white cedar (*Thuja occidentalis* L.) along a major road near Manitouwadge, Terrace Bay District, have suffered damage for a couple of years and now appear close to death. Elsewhere in the region, scattered pockets of damage occurred at numerous locations along the major roadways.

SPECIAL SURVEYS

Black Spruce Plantation Survey

The Forest Insect and Disease Survey (FIDS) Unit has for the past several years conducted surveys for pest problems in conifer plantations. In northern Ontario, black spruce, white spruce and jack pine are examined on an annual rotation basis. In 1986, 12 black spruce plantations in the North Central Region were examined for the presence of insects and diseases. Two visits were made to each of the plantations to account for differences in the seasonal occurrences of the pest organisms. The first visit was scheduled between 9 and 27 June and the second between 14 July and 1 August. Only successful plantations were examined in a variety of age and height categories.

The spruce budworm, the most commonly found of all insects, was recorded at all 12 locations. Defoliation, however, ranged only up to 5%. The spruce bud midge, *Rhabdophaga swainei* Felt, occurred at eight locations, with a high of 46.7% of the trees affected at one plantation. Up to 6% of the leaders were attacked by the white pine weevil, which was found at seven locations. Spruce needle rust, the most prevalent disease, was present at 10 locations. Defoliation ranged up to a high of 7%. Armillaria root rot was identified as the killer of trees at three sites. Frost damage was common across the region (see ABIOTIC DAMAGE) and occurred in all but one of the plantations surveyed. Shoot damage, as a result of frost, ranged up to 13.5%. Spruce cone rust occurred at three of the plantations. Results of the 1986 survey are summarized in Table 7.

Insects and diseases that were specifically searched for but were not present included the spruce coneworm, yellowheaded spruce sawfly, sawyer beetles, *Monochamus* spp., spruce broom rust, *Chrysomyxa arctostaphyli* Dietel, and eastern dwarf mistletoe, *Arceuthobium pusillum* Peck.

Black Spruce Cone and Seed Survey

As part of a continuing program dealing with cone damage and seed loss of commercial tree species, cone samples of black spruce were submitted for detailed laboratory analysis from four locations in 1986. The samples were taken in late July while the cones were in a semimature stage. Two lowland and two upland sites were selected and 100 cones were submitted from each location. The number of damaged cones was low at all locations and the seed loss within the damaged cones ranged from 8 to 41% (Table 8). The agents responsible for the seed loss are also listed in the table.

Table 7. A summary of insect, disease and abiotic damage detected in a special survey of high-value black spruce in the North Central Region (percentages based on the examination of 150 trees at each location).

Location	Avg ht of trees (m)	Plantation area (ha)	Estimated trees ha)	Spruce budworm		Spruce bud midge	White pine weevil
				Trees attacked (%)	Defoli-ation (%)	Trees attacked (%)	Leaders attacked (%)
Atikokan District							
Kerr Lake	1.0	5	2,500	40.0	1.0	3.0	1.0
Geraldton District							
East Rd km 29	2.0	3	1,600	3.3	1.0	5.0	3.3
Kimberly-Clark nursery	5.1	2	500	4.0	1.0	0.0	0.0
McQuesten Twp	3.3	10	2,500	4.0	1.0	1.0	0.0
Nipigon District							
Camp 75	3.3	50	2,500	61.3	2.0	46.7	0.0
Limestone Lake-M.U.	3.7	50	2,500	26.6	1.0	0.0	0.0
Stirling Twp	4.2	20	2,000	90.0	5.0	14.0	0.0
Terrace Bay District							
Davies Twp	1.8	25	2,500	22.0	2.0	0.0	1.7
Thunder Bay District							
East Bay Rd	1.3	10	2,500	28.0	2.0	42.0	2.0
Fraleigh Twp	1.3	8	1,800	40.0	1.0	0.0	2.0
Goldie Twp	2.3	8	2,000	45.0	1.0	9.0	6.0
Mere Lake	4.6	8	2,000	43.3	1.0	12.0	1.0

(cont'd)

Table 7. A summary of insect, disease and abiotic damage detected in a special survey of high-value black spruce in the North Central Region (percentages based on the examination of 150 trees at each location) (concl.).

Location	Avg ht of trees (m)	Cone rust		Frost		Armillaria root rot	Spruce needle rust	
		Cones examined	Cones affected (%)	Trees affected (%)	Defoliation (%)	Trees attacked (%)	Trees attacked (%)	Defoliation (%)
Atikokan District								
Kerr lake	1.0	38	0	16.0	3.0	2.0	76.0	2.0
Geraldton District								
East Rd km 29	2.0	41	0	53.3	3.7	1.0	86.6	2.4
Kimberly-Clark nursery	5.1	100	0	64.0	9.5	0.0	99.0	2.9
McQuesten Twp	3.3	37	0	0.0	0.0	0.0	100.0	2.4
Nipigon District								
Camp 75	3.3	21	0	98.7	13.5	0.0	0.0	0.0
Limestone Lake-M.U.	3.7	50	0	73.3	10.2	0.0	33.0	1.0
Stirling Twp	4.2	125	0	87.0	9.0	0.0	4.0	1.0
Terrace Bay District								
Davies Twp	1.8	35	0	76.6	11.0	0.0	98.0	3.1
Thunder Bay District								
East Bay Rd	1.3	70	10	34.0	2.0	1.0	83.0	7.0
Fraleigh Twp	1.3	40	0	77.0	6.0	0.0	0.0	0.0
Goldie Twp	2.3	100	1	51.0	1.0	0.0	59.0	1.0
Mere Lake	4.6	100	8	17.0	1.0	0.0	100.0	5.0

Table 8. Summary of black spruce cone and seed survey at four locations in the North Central Region in 1986.

Location	Site	Damaged cones (%)	Seed loss within damaged cones (%)	Responsible agents (in order of importance)
Geraldton District				
Kimberly-Clark Seed Orchard	upland	10	15	Spruce cone maggot, *Lasiomma anthracinum* (Czerny) Lepidopterous damage Spruce cone axis midge, *Dasineura rachiphaga* Tripp Unknown cause
Oakes Twp	lowland	11	37	Unknown cause Spruce cone axis midge Lepidopterous damage
Nipigon District				
Stirling Twp	upland	9	41	Unknown cause Spruce cone maggot
Thunder Bay District				
East Bay Road	lowland	3	8	Unknown cause Spruce seed midge, *Mayetiola carpophaga* (Tripp)

Gypsy Moth, *Lymantria dispar* (L.)

The pheromone trapping program to monitor the spread of this insect was continued in 1986. Traps are designed to attract and capture male moths. Two pheromone traps were deployed at each of 10 provincial parks and one township park across the region (see frontispiece). Traps were checked periodically and then collected late in the field season when the moth stage of the insect was completed. All results in 1986 were negative.

Hypoxylon Canker Survey

In 1986, four semipermanent study plots were examined to study the effects of Hypoxylon canker, *Hypoxylon mammatum* (Wahlenb.) J. Miller, on mature aspen trees in the area. These plots were established in 1984. Table 9 shows that, in general, there have been increases of the disease throughout the sample plots.

Table 9. Summary of damage caused by Hypoxylon canker of aspen in four study plots in North Central Region in 1984 and 1986 (counts based on 150 randomly selected trees at each location).

Location	Avg dbh of trees (cm)	Avg ht of trees (m)	Estimated stand area (ha)	% of tree diseased				Current mortality (%)	
				branch		stem			
				1984	1986	1984	1986	1984	1986
Geraldton District									
Ashmore Twp	16	17	10	0	0	3	5	1	2
Oakes Twp	15	15	10	0	0	3	8	2	4
Thunder Bay District									
Blackwell Twp	23	19	20	0	1	1	2	0	0
Devon Twp	20	23	10	0	0	1	1	0	1

Pinewood Nematode, *Bursaphelenchus xylophilus* (Steiner and Buhrer)

Intensive sampling was carried out in 1985 and 1986 to determine the distribution of this nematode in the region. Sampling entails obtaining disc samples from recently dead suspect trees and then examining these in the laboratory to determine the presence or absence of the nematode. It is a long process and many samples have been submitted to the Biosystematics Research Institute in Ottawa for confirmation of the identification.

In all, 52 areas have been sampled in the past 2 years and all but three samples have been processed (Fig. 4). The pinewood nematode has been positively identified from 15 of the locations. Table 10 lists these locations and the host species, and provides identification results. The last three samples listed in the table are from long-horned beetles, which are believed to be vectors of the nematode. Surveys will be continued in 1987 as it is unclear how much damage, if any, can be attributed to the pinewood nematode.

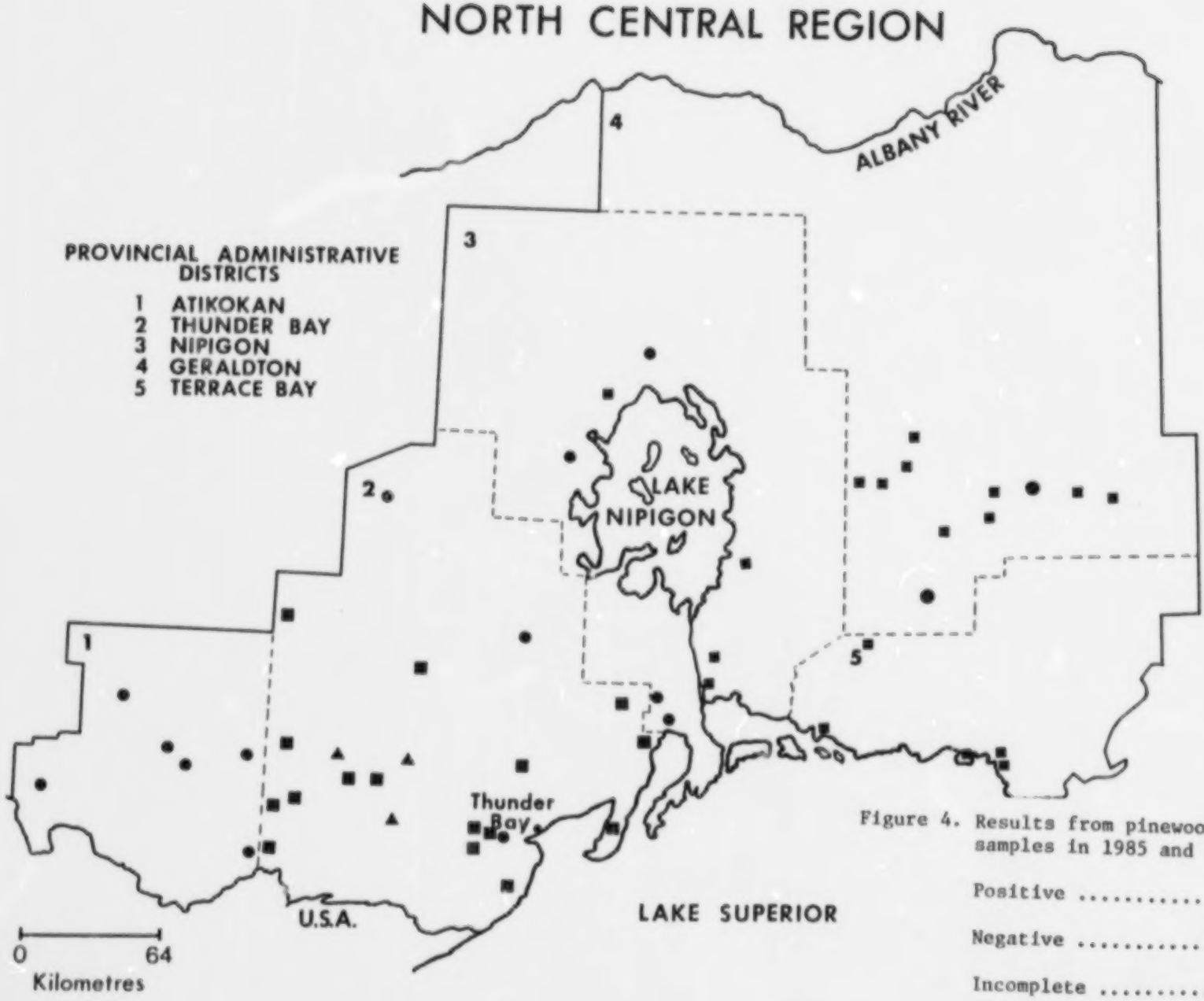

Figure 4. Results from pinewood nematode samples in 1985 and 1986

Positive .....●

Negative .....■

Incomplete .....▲

Table 10. Results of sampling for pinewood nematode in 1985 and 1986.

District	Location	Year sampled	Species[a]	Result
Atikokan	Saganagons Lk	1985	bF	positive
	Hwy 11-Southwest of Plateau Lk	1985	jP	positive
	Hwy 11-Windigoostigwan Lk	1985	bF	positive
	Stanten Lk Rd	1986	jP	positive
	Flanders Rd	1986	jP	positive
	Hwy 807	1986	jP	positive
Geraldton	Greta Rd, km 12	1985	jP	negative
	Greer Rd, Treptow Cr	1985	jP	negative
	Hwy 584, km 25	1985	bF	negative
	Hwy 584, south of Nakina	1985	jP	negative
	Daley Twp	1985	jP	negative
	Klotz Lake Prov. Pk	1985	wS	negative
	Caramat Rd-8 km north of Caramat	1985	jP	negative
	Caramat Rd, jct Hwy 11	1985	jP	negative
	Hwy 11, Nibs Lk	1986	jP	negative
	Hwy 11, west of Klotz Lk	1986	jP	positive
	Catlonite Rd	1986	jP	positive
Nipigon	Lyon Twp	1985	bF	positive
	Hele Twp	1985	jP	positive
	Summers Twp	1985	jP	negative
	Corrigal Twp	1985	bF	negative
	Ledger Twp	1985	jP	negative
	Hwy 527-Kopka R.	1986	jP	positive
	Pikitigushi Rd	1986	jP	positive
	S. of Armstrong Airport	1986	jP	positive
Terrace Bay	Killraine Twp	1985	bS	negative
	Coldwell Twp	1985	rP	negative
	Pic Twp	1985	rP	negative
	Pic Twp	1985	jP	negative
	Goldfield Rd, km 32	1985	jP	negative

(cont'd)

Table 10. Results of sampling for pinewood nematode in 1985 and 1986 (concl.).

District	Location	Year sampled	Species[a]	Result
Thunder Bay	Dorion Twp	1985	wP	negative
	Lamport Twp	1985	bS	negative
	Greenwater Lk	1985	bF	negative
	McGinnis Lk	1985	bF	negative
	Powell Lk	1985	bF	negative
	Ross Lk	1985	bF	negative
	Blake Twp	1985	bF	negative
	Paipoonge Twp	1985	ScP	negative
	Wolfpup Lk Rd	1985	bF	negative
	Paipoonge Twp	1985	bS	negative
	Paipoonge Twp	1985	jP	positive
	Batwing Lake-Boreal Rd	1985	jP	incomplete
	Conacher Twp	1985	jP	incomplete
	Hwy 802	1985	bF	incomplete
	Sibley Twp	1985	*Monochamus scutellatus*[b]	negative
	Jaques Twp	1985	*Monochamus scutellatus*[b]	negative
	Paipoonge Twp	1985	*Arhopalus foveicollis*[b]	negative
	Camp 234	1986	bF	negative
	East of English River	1986	jP	negative
	km 87 N of Graham	1986	jP	positive
	Hwy 527-Poshkokgan R.	1986	jP	positive
	Brule Cr Rd	1986	jP	negative

[a] bF = balsam fir, jP = jack pine, wS = white spruce, bS = black spruce, rP = red pine, wP = white pine, ScP = Scots pine

[b] long-horned beetles, believed to be vectors of the nematode

Acid Rain National Early Warning System (ARNEWS)

A continuing survey of three semipermanent plots in the North Central Region is being conducted by FIDS personnel at the Great Lakes Forestry Centre to check for symptoms of acid rain. These 400-m^2 plots are located in Fowler Township, Thunder Bay District, Wiggins Township, Terrace Bay District and the Margo Lake region of Geraldton District. They are distributed so as to reflect the major commercial tree species of the region: white spruce, black spruce, jack pine and white birch. Surveys were conducted on these plots throughout the field season to evaluate any possible damage caused by acid rain. No damage attributed to acid rain was found. Several insect pests were present, including spruce budworm and birch leafminer.

Climatic Data

Extremes in the various meteorological phenomena can have an impact on the forest. The atmospheric conditions that have the most potential for causing damage to trees are temperature, precipitation and wind. Table 11 lists mean monthly temperatures and total precipitation for 1986 from two locations in the region, with the deviation from a 30-year normal. Whenever possible, weather-related damage is surveyed as it occurs and is included as a separate entry in this report under "ABIOTIC DAMAGE".

Table 11. A summary of temperature and precipitation for 1986 from two locations in the North Central Region.

Location	Month	Mean temperature (0°C)		Deviation from normal (0°C)	Total precipitation (mm)		Deviation from normal (0°C)
		Actual	Normal		Actual	Normal	
Geraldton Airport	January	-18.6	-20.0	+1.4	21.8	38.2	-43
	February	-16.9	-17.9	+1.0	34.2	33.3	+ 3
	March	- 7.9	-11.0	+3.1	24.0	38.2	-37
	April	1.8	- 0.5	+2.3	39.8	43.3	- 8
	May	11.4	7.7	+3.7	37.0	63.2	-41
	June	11.8	13.5	-1.7	139.0	91.9	+51
	July	17.4	16.3	+1.1	65.2	81.6	-20
	August	14.5	14.6	-0.1	92.8	66.8	+40
	September	8.2	9.3	-1.1	95.0	75.6	+26
	October	2.3	3.9	-1.6	74.6	64.6	+15
	November	- 9.4	-5.5	-3.9	56.2	61.5	- 9
	December	- 9.9	-15.4	+5.5	35.6	38.8	- 8
Thunder Bay Airport	January	-13.1	-15.4	+2.3	30.1	40.9	-26
	February	-11.2	-13.0	+1.8	39.6	29.3	+39
	March	- 3.8	- 6.3	+2.5	29.4	45.0	-35
	April	4.8	2.5	+2.3	54.8	50.7	+ 8
	May	11.4	8.8	+2.6	70.4	73.3	- 4
	June	13.4	14.0	-0.6	77.2	76.6	+ 1
	July	17.7	17.6	+0.1	97.6	75.4	+29
	August	15.6	16.4	-0.8	61.8	83.1	-26
	September	10.6	11.1	-0.5	83.1	89.1	- 7
	October	4.3	5.7	-1.4	28.4	54.8	-48
	November	- 5.4	2.6	-8.0	62.7	52.9	+19
	December	- 7.2	-11.1	+3.9	9.8	41.1	-76